CALIFORNIA
OCCUPATIONAL GUIDES

Employment Development Department
State of California

COMPUTER PROGRAMMERS

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INTEREST AREA
PROFESSIONAL AND MANAGERIAL

WHAT DOES A COMPUTER PROGRAMMER DO?

COMPUTER PROGRAMMERS write, test, and maintain programs or software that tell the computer what to do. They convert project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language. They develop and write computer programs to store, locate, and retrieve specific documents, data, and information. They may program Web sites.

Computer Programmers perform some or all of the following tasks:

- Write programs creating a logical series of instructions the computer can follow, applying knowledge of computer capabilities, subject matter, and symbolic logic.
- Code instructions into programming languages and test and debug programs to get intended results.
- Analyze, review, and rewrite programs, using workflow charts and diagrams.
- Convert detailed logical flow charts to language that computers can process.
- Prepare flow charts and block diagrams and encode resultant equations for processing.
- Develop programs from workflow charts or diagrams, considering computer storage capacity, speed, and intended use of output data.
- Prepare detailed workflow charts and diagrams from programs to illustrate sequence of steps to describe input, output, and logical operation.
- Write documentation of program development and subsequent revisions.
- Revise or direct revision of existing programs to increase operating efficiency or adapt to new requirements.
- Consult with managerial and engineering and technical personnel to clarify program intent, identify problems, and suggest changes.
- Write instructions to guide operating personnel during production runs.
- Prepare records and reports.
- Collaborate with computer manufacturers and other users to develop new programming methods.
- Assist computer operators or system analysts to resolve problems in running computer programs.
- Assign, coordinate, and review work and activities of programming personnel.
- Train subordinates in programming and program coding.

Computer Programmers are also commonly called Programmer Analysts, Scientific Programmers, Software Programmers, Systems Programmers, and Business Programmers.

WHAT SKILLS ARE IMPORTANT?

Programmers require and use some or all of the following skills, knowledge, and abilities to perform their work:

- Programming – Writing computer programs for various purposes.
- Writing – Communicating effectively with others in writing as indicated by the needs of the audience.
- Reading Comprehension – Understanding written sentences and paragraphs in work-related documents.
- Critical Thinking – Using logic and analysis to identify the strengths and weaknesses of different approaches.
- Information Organization – Finding ways to structure or classify multiple pieces of information.
- Computers and Electronics – Knowledge of electric circuit boards, processors, chips, and computer hardware and software, including applications and programming.
- Mathematics – Knowledge of numbers, their operations, and interrelationships including arithmetic, algebra, geometry, calculus, statistics, and their applications.
- Oral Expression – The ability to communicate information and ideas in speaking so others will understand.
- Oral Comprehension – The ability to listen to and understand information and ideas presented through spoken words and sentences.
- Written Expression – The ability to communicate information and ideas in writing so others will understand.
- Written Comprehension – The ability to read and understand information and ideas presented in writing.
- Deductive Reasoning – The ability to apply general rules to specific problems to come up with logical answers. It involves deciding if an answer makes sense.

WHAT'S THE WORK ENVIRONMENT?

Computer Programmers generally work in an office environment. Programmers are known to work long hours with intense workloads against tight deadlines. The "debugging" phase of programming can be the most stressful. Most Programmers work alone but some are expected to work in teams and interact directly with users. A growing trend in the field of computer programming is the virtual office, also known as telecommuting.

Union Membership

While union membership is not common in this occupation, Computer Programmers who work for government agencies often belong to a union.

WHAT'S THE CALIFORNIA JOB OUTLOOK?

The following information is from the occupational projections produced by the Employment Development Department's Labor Market Information Division:

Estimated number of workers in 1998:	74,600
Estimated number of workers in 2008:	86,700
Projected Growth 1998-2008:	16.2%
Est. openings due to separations by 2008:	25,000

These figures do not include self-employment.

The estimated number of job opportunities for Computer Programmers from 1998 through 2008 is expected to total 12,100. The Computer Programmer occupation will grow slower than average compared with all occupations in California.

Trends

As part of the large computer and data processing industry, the number of jobs in data processing firms, software houses, and computer consulting businesses are numerous. Due to new technologies, Programmers will be needed to update new languages in outdated systems. However, Programmers will face increasing competition from overseas businesses where work is done at a lower cost.

WHAT DOES THE JOB PAY?

California Earnings

Computer Programmers 2001 Wages	
Hourly wages range from	$23.97 to $41.41
Average hourly wage	$32.96
Average annual wage	$68,549

Source: Occupational Employment Survey of Employers by EDD/LMID.

Hours

Most Programmers work a standard 40-hour week. However, hours can be long and overtime required as emergencies and deadlines arise.

Benefits

Most companies offer benefit packages that include sick leave, vacation, holidays, retirement, and stock-option plans.

HOW DO I PREPARE FOR THIS JOB?

Education and Training

The majority of Computer Programmers have a bachelor's degree in computer science, mathematics, or information systems. Because programming tasks are becoming more complex, employers are beginning to require Programmers to have a four-year degree. Employers hiring Programmers for scientific or engineering applications prefer college graduates with a degree in computer or information science, mathematics, engineering, or the physical sciences. Companies that use their systems for business applications favor college graduates with a concentration in management information systems (MIS), or business. Some employers within this industry require a master's degree. In addition, Computer Programmers must have extensive knowledge of operating systems and the ability to work with database systems.

Computer Programmers should be trained in a number of programming languages that may include:

- C++
- Visual C+++
- Visual Basic
- Java
- Perl
- HTML
- Ada
- Graphic and User Interface (GUI)
- PowerBuilder
- FORTRAN
- COBOL
- CASE tools

Licensing and Certification

Professional certification has emerged in the industry as a means of ensuring competency levels of Programmers. The Institute for Certification of Computing Professionals (ICCP) administers a program of study and examination to qualify members to use the title Certified Computing Professional (CCP). Candidates must have four years of experience or two years of experience and a college degree. To qualify, individuals must pass a core examination plus exams in two specialty areas, or an exam in one specialty area and two computing languages. Those with little or no experience may be tested for certification as an Associate Computer Professional (ACP).

Continuing Education

Computer Programmers must continuously update their skills and knowledge due to the ever-changing programming industry. Most employers will cover the costs of continuing education.

HOW DO I FIND THE JOB?

Direct application to employers remains one of the most effective job search methods. Private firms are listed in the yellow pages under Computers – Programming and Consulting or Data Processing Services. California job openings can be found at various online job-listing systems including CalJOBS℠ at www.caljobs.ca.gov or at America's Job Bank at www.ajb.dni.us.

Non-experienced Programmers should also:

- Seek work as a Programmer trainee in a large organization.

- Take State and federal civil service examinations for entry-level Programmers.
- Participate in college internships and volunteer work.
- Become certified as an Associate Computer Professional.

Experienced Programmers should also:

- Read classified ads in newspapers and trade journals.
- Become certified as a Certified Computing Professional.

For other occupational and wage information and a listing of the largest employers in any county, visit the Employment Development Department Labor Market Information Web page at www.calmis.ca.gov. Find further job search assistance from your nearest Job Service office at www.edd.ca.gov/jsloc.htm or the closest One-Stop site listed on the California WorkNet site, www.sjtcc.ca.gov/sjtccweb/one-stop.

WHERE CAN THIS JOB LEAD?

For experienced workers, the prospects for advancement are good. In large organizations, they may be promoted to Lead Programmers and be given supervisory responsibilities. Some Applications Programmers become Systems Programmers after they acquire additional experience and complete courses in systems software. Both Applications Programmers and System Programmers may become Systems Analysts or be promoted to managerial positions. Some Programmers start their own software companies that specialize in a particular niche of programming such as games or business accounting software.

OTHER SOURCES OF INFORMATION

Institute for the Certification of Computer Professionals (ICCP)
2350 East Devon Avenue, Suite 115
Des Plaines, IL 60018-4610
(847) 299-4227
(800) 843-8227
www.iccp.org

Society for Industrial and Applied Mathematics (SIAM)
3600 University City Science Center
Philadelphia, PA 19104-2688
(215) 382-9800
(800) 447-7426
www.siam.org

JFP Resources
1085 South 124th Street
Brookfield, WI 53005
(262) 782-0072
www.prgjobs.com

Employment Projections by Occupation
www.calmis.ca.gov/htmlfile/subject/occproj.htm

Employment and Wages by Occupation
www.calmis.ca.gov/file/occup$/OES$.htm

RELATED OCCUPATIONAL GUIDES

Computer Operators	No. 299
Computer Systems Engineers	No. 488
Computer Systems Analysts	No. 541
Web Page Designers and Webmasters	No. 559

OCCUPATIONAL CODE REFERENCES

SOC *(Standard Occupational Classification)*

Computer Programmers	15-1021

O*NET *(Occupational Information Network)*

Computer Programmers	15-1021.00

OES (*Occupational Employment Statistics*)

Computer Programmers	25105

DOT (*Dictionary of Occupational Titles*)

Computer Programmer	030.162-010
Programmer, Engineering, and Scientific	030.162-018